

FULL MARKS
= 30

STATS 3N03 / 3J04 - TOZ SOLNS

2005-11-04

1. Let Y = total weight of n randomly chosen people

① * ASSUME: Distribution of weight is close enough to normal that Central Limit Theorem applies to total weight
 $\therefore Y \sim N(66n, 10^2 n) \Rightarrow P(Y > 750) = 1 - \Phi\left(\frac{750 - 66n}{10\sqrt{n}}\right)$

$n=9$ $P(Y > 750) = 1 - \Phi(5.2) < 0.000033$ (LAST VALUE ON TABLE II)

⑦ $n=10$ $P(Y > 750) = 1 - \Phi(2.846) = 0.0022 > 0.001$

* \Rightarrow CAN ALLOW 9 PEOPLE AT ONE TIME

① * If people of like size tend to board the elevator together, they would be positively correlated, so $\text{Var}(Y) > 10^2 n$ and $P(\text{overload})$ would be higher than computed here.

2. $P(A) = \frac{2}{3}$ $P(B) = \frac{1}{3}$ $P(X=6|A) = e^{-5} \frac{5^6}{6!}$ $P(X=6|B) = e^{-10} \frac{10^6}{6!}$

since $X \sim \text{Poisson}$ with mean = 5 in line A, mean = 10 in line B.

⑦ $P(A|X=6) = \frac{P(X=6|A)P(A)}{P(X=6|A)P(A) + P(X=6|B)P(B)} = \frac{e^{-5} \frac{5^6}{6!} \frac{2}{3}}{e^{-5} \frac{5^6}{6!} \frac{2}{3} + e^{-10} \frac{10^6}{6!} \frac{1}{3}}$
 $= \frac{1}{1 + e^{-5} 2^5} = 0.8226$

3. Let X = diameter; Assume normality, so $X \sim N(5, .1^2)$

④ $P(\text{unacceptable}) = P(X < 4.7) + P(X > 5.3) = \Phi\left(\frac{4.7-5}{.1}\right) + \{1 - \Phi\left(\frac{5.3-5}{.1}\right)\}$
 $= \Phi(-3) + \{1 - \Phi(3)\} = 2\Phi(-3) = 2(0.0044) = 0.0088$

Let Y = no. unacceptable out of 10000; $Y \sim \text{Bin}(10000, 0.0027)$

④ $P(Y > 35) = 1 - P(Y \leq 35) = 1 - \sum_{y=0}^{35} \binom{10000}{y} (0.0027)^y (0.9973)^{10000-y}$

$\approx 1 - \Phi\left(\frac{35.5 - 27}{\sqrt{27(0.9973)}}\right) = 1 - \Phi(1.638) = 0.051$

① * To achieve 6-sigma quality, improve the manufacturing process to reduce σ_x from 0.1 to 0.05.

4. Define statistic & sampling distribution. Gosset discovered the

⑤ t distribution, worked for Guinness Brewery, WILLIAM SOKALY.